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# THE DESIGN AND EVALUATION OF INSTITUTIONAL ARRANGEMENTS FOR WATER PLANNING AND MANAGEMENT

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# PREFACE

The importance of the institutional arrangements within which water planning and management are carried out has been increasingly recognized. The United Nations has itself published a number of significant volumes on the subject which can be found in the list of references at the end of this paper. Continuing work in several countries aims at a more solid analytical base for the evaluation and design of water planning and management institutions.

The outlines for the analysis found in this paper evolved from the discussions of an international group of highly experienced water planners held at Vancouver in July 1975. The concern of that conference was an analysis of the institutional barriers to more effective water planning and management. A great deal of credit is due each of the participants for their contributions to this report.

Nineteen countries have been represented in this study through country papers invited from individuals knowledgeable about water affairs in those countries. These papers provided data on water planning and expert opinion on questions relating to the effectiveness of water planning. The countries discussed are Argentina, Botswana, Brazil, Canada, France, the German Democratic Republic, Hungary, India, Indonesia, Iran, Israel, Mexico, Pakistan, Spain, the Union of Soviet Socialist Republics, the United Kingdom, the United Republic of Tanzania, the United States of America and Venezuela.

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# I. INTRODUCTION AND BACKGROUND

The past few years have seen a growing interest in the institutional framework within which water planning, development and management take place. This concern has stimulated several studies of procedures and institutions as they have evolved in a number of countries. 1/ These studies serve to reinforce the impression that the weaknesses in water planning and management stem from institutional short-comings much more than from a lack of appropriate analytical techniques.

The Conference on Water Development in Less Developed Areas (Berlin, 1963) found that "the main problems in the field are not technical, but are of an organizational, administrative, political, managerial, or financial nature ... Assisting nations may often be more helpful in solving these problems than in providing either engineering or financial aid" (1, p. 38).

In the United Nations-sponsored study of North American water planning (6, pp. 59-60), it was concluded that:

> "The record seems quite clear that the matter of greatest concern is the achievement of co-ordination in planning and management of water resource systems: co-ordination among those many agencies usually found in several ministries and at different levels of government ... Until agencies' operation within a river basin can be co-ordinated so that the efficiency and equity implications of basin-wide alternative development programmes can be analysed and intelligent selection made ... with a high probability of expeditious execution, more sophisticated planning and projection techniques will be useless ...
>
> "Technique has already far outrun the 'absorptive capacities' of planning and operating agencies usefully to assimilate sophisticated study results and sophisticated tools. This points up the need for continuity in the functions and responsibilities of the agencies charged with planning, a need not sufficiently recognized in any of the three countries studied."

In summary, co-ordination of agencies and continuity of planning and management are currently not achieved in the water planning programmes of many countries. Development of these characteristics may well have a higher return than attempts to employ more sophisticated planning and design techniques under existing institutional arrangements. Only within an appropriate institutional framework will sophisticated techniques be able to yield a return sufficient to justify their use.

However, it remains unclear to what extent general assertions can be made regarding "optimal" or appropriate institutional design. Fox et al (7, p. 158) state:

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1/ Figures in parentheses refer to the numbered entries in the list of references at the end of this paper.

> "Of foremost importance, the study strongly supports the view that institutional design should be determined by factors that may differ widely from region to region."

The United Nations integrated river basin development study (8, p. 27) states that:

> "There is certainly no single correct way to organize and administer a river basin programme. The plan of organization must in each case be fitted into the general governmental structure and into the cultural patterns and political traditions of the countries and regions which are involved."

In discussing the complexities of Canadian water, the late E. Roy Tinney and R. J. Van Loon (9) stated:

> "If one hopes to achieve optimum results in every instance, the only hope in Canada lies in a co-operative, flexible approach. A rigid institutional arrangement is clearly inappropriate under such diverse conditions."

A major question, then, is "What general propositions about effective institutional design and evaluation can we infer from the collective experience of nations which will be of direct applicability to other countries which are searching for more effective planning and management systems?"

The purposes of this paper are to propose a conceptual schema for describing and evaluating institutional arrangements for water planning and management and to summarize the experience of a number of countries, organizing these summaries around the principal parts of the proposed conceptual schema.

## II. DEFINING THE INSTITUTIONAL FRAMEWORK

The institutional framework within which water planning and management take place contains many things, among them technical personnel and bureaucracies which have their own perceptions of what the problems are, what is feasible, and what the political process is and organizations having their internally and externally oriented political behaviour. In countries where projects typically originate at the local level and must progress through successively higher levels of approval, a particularly high premium is placed on understanding and dealing with the political process. The organization of water programmes thus clearly involves many functions, of which technical planning operations are only a part. Consequently, a broad view of the institutional framework must be taken during any attempt at assessment or design.

The following taxonomy for components of the institutional framework has evolved from the deliberations of a group of planners and scholars who have been working on the problem of institutional design:

Rules of the game

(a) Laws and case law pertaining to the ownership and use of water;

(b) Laws and case law pertaining to the authority for and administration of water planning and management;

(c) Laws and/or administrative rules pertaining to procedures to be used in water planning and management (e.g., the United States Water Resources Council's Principles and Standards of 1973);

(d) International treaty obligations.

Organizational structure

(a) The set of water agencies, each assigned a set of planning and/or management tasks with related authority;

(b) Sets of government and non-government decision makers which must approve or can influence the "rules of the game", policy, and water-related budgets - for example, legislative committees, executive agencies, interministerial committees or task forces, appeals boards, and national or regional special-interest groups;

(c) Agency structure - sets of formally and informally defined relations consisting of:

(i) interagency authority structure: who can tell whom to do what?

(ii) administrative procedures, including channels of co-ordination and information flow among water agencies;

(iii) informational and educational linkages to external parties, including decision makers.

Publicly held values and perceptions

(a) Perceptions regarding the roles of government and planning generally;

(b) Perceptions about water as a resource: the nature of water-related problems and the "water is different" syndrome;

(c) Perceptions of water agencies in particular: their proper roles, their effectiveness and the credibility of their informational and educational ties to external publics.

The components listed above may be thought of as comprising a shell or framework within which technical planning procedures, such as demand forecasting, hydrological data gathering, model building, structural design, benefit/cost studies, and environmental impact assessments, take place. However, such an interpretation incorrectly pictures this framework as static and beyond the reach of planned change. The components of this framework do change, sometimes in an evolutionary process over time and, at other times, as a result of explicit planning.

Indeed, the distinctions among the institutional framework, administrative procedures and technical planning operations blur at the margin. If a new channel of communication is opened between hydraulic engineers and fisheries biologists, and if their work becomes co-ordinated through regular meetings and a mutual review of reports, does this constitute a change in the institutional framework or a change in technical planning procedures? The answer is not clear, but the distinction remains a useful one.

In writing about rural development planning, Chambers has noted (10) that the most popular diagnoses of development planning short-comings seem to be a lack of high-level manpower, poor attitudes among public servants, lack of integration and co-ordination, and inappropriate institutional structures. In that author's opinion, these factors are far too superficial and vague to represent an understanding of the real problems. What often lies behind these vaguely defined conditions is a need for clearly conceived detailed procedures for getting the work done and for providing proper motivation. Such detailed consideration is often not attractive to the higher official or the outside consultant, so much more sweeping and costly recommendations are often made, e.g. to set up a new organization, realign ministerial responsibilities or internally reorganize agencies.

Each of these recommendations has high costs associated with it. New organizations always have high opportunity costs in terms of personnel transferred from existing agencies, overhead costs and (often) reliance on foreign personnel. In realigning ministerial responsibilities, Chambers notes that the appearance of change on paper is often not matched by changes in working realities. "When the dust has settled, however, the staff of the department are usually found to be sitting at the same desks in the same offices doing the same work" (10, p. 26).

These observations should serve as a warning that naive shuffling of the institutional framework will get us no further than the naive adoption of the latest fad in computer models.

## III. CLASSIFICATION AND ILLUSTRATIONS OF ALTERNATIVE INSTITUTIONAL FRAMEWORKS

Subsection A below introduces a classification of the basic laws governing the ownership of water with examples from the countries surveyed in this study. Subsection B introduces a classification of organizational structures according to the degree of centralization and is supplemented by an annex describing in outline form the organizational structures of the surveyed countries. Subsections C, D and E then illustrate the co-ordinating, linking and funding arrangements found in these countries. A final annex presents a brief case study illustrating the profound impact on system efficiency that seemingly minor differences in the degree of centralization and in property rights can have.

### A. Basic laws or traditions governing the ownership of water

The basic legal right to the use of water is integrally linked to the potential ways in which water planning and management can be organized. The majority of countries around the world assert that water resources are in public ownership, but the meaning of that phrase varies in so many ways that a complete description of all alternatives would be nearly impossible. Similarly, countries which permit the private ownership of water surround that right with many conditions and restrictions, so that no water-using party in even modestly populated and developed parts of the globe has carte blanche to water use with the possible exception of household use.

The different legal traditions of water ownership all have their positive and negative points. Well-defined ownership by the central Government can mean a superior ability to proceed with water development projects without the delay of buying up or otherwise obtaining the necessary water rights. Central state ownership can also mean a more expeditious reallocation of existing supplies among uses as conditions change, without those supplies being constrained by provincial, state, local or private claims. On the other hand, such a system can fail to detect the need for transfers or the existence of physical and economic

inefficiencies in use, and can fail to motivate technological changes in water management called for by changing conditions of demand and supply. Central ownership may be insensitive to provincial or local problems and priorities, whereas provincial, state or private ownership can necessitate compromise solutions which recognize these factors.

A survey of the countries listed in the preface suggests four categories of basic laws of water ownership: central government ownership and control; central/provincial (or state) government ownership and control; co-operative social ownership and control with qualified private access to supplies; modified private ownership. Each of these categories is listed below with variations as observed in the surveyed countries.

Central government ownership and control

All surface, ground and reclaimed supplies are public (central Government) property and all uses are subject to licensing for limited periods of time;

All supplies are public (central Government) property, but use-contracts associated with particular parcels of land in practice remain in effect indefinitely and are transferred when the land changes ownership;

All supplies are publicly owned (by the central Government) but small uses (up to 22 $m^3$ per day) can be withdrawn for domestic and livestock purposes without a licence.

Central/provincial (or state) ownership and control

The central Government controls all surface waters except water bodies totally within the boundaries of a State. The status of ground water is unclear;

Provinces have ownership of all water and other natural resources within their boundaries. The central Government retains jurisdiction over international boundary waters, navigation, lake and maritime fisheries;

Ownership of all waters is with the province except for interprovincial rivers which have been declared by the national legislature to be under the control of the central Government in the national interest;

All large water bodies, including reservoirs, are provincially owned, but some small water bodies and control structures are privately or co-operatively owned.

Co-operative social ownership and control with qualified private access

(Note: this category is meant to include riparian systems that allow private access but presumably disallow negative externalities from private use.)

Riparian parties have the right to use ground water, streams and canals, but the law now requires permits to be obtained for the historically used quantities. These permits are transferable with the land;

Riparian parties have rights to use surface waters. Large ground-water users must be metered and can be constrained.

Modified private ownership

Local traditions are allowed to prevail when not clearly contradicting the national interests. Farmers' associations control irrigation uses;

Under the "appropriations doctrine" of some arid areas, water is a private property with rights determined by the time, place and nature of the earliest use. Rights can be transferred or sold among private parties, subject to the absence of injury to third parties as determined by a water authority or court.

Two points are worth noting: (1) the licensing of water use for specific periods of time can create a flexibility and transferability of water among uses which is highly desirable in the long run, while permits or rights which are, in effect, permanent and attach to specific lands reduce flexibility and inhibit transfers; (2) the status of ground water is left unclear in many systems, reducing the motivation for beneficial conjunctive management and increasing the possibility of undermining even surface-water management systems. Often within administrative structures, surface- and ground-water administrations are separated - a very poor practice in general.

## B. Classification of organizational structures

The possible variations in organizational structure are infinite in number, although many of the apparent differences are created by the drafting of formal organization charts rather than by differences in actual functioning. Increasing attention is being given to underlying theories (political, administrative and behavioural) of organization (7, 12) in the hope of explaining differences in observed organizational performance and for the derivation of guidelines for the design of better institutions. No such body of theory currently exists, although the framework set out in section IV of this study represents a simple beginning.

A survey of the organizational structures of the surveyed countries has suggested a rough classification scheme: centralized; co-ordinated-decentralized; and decentralized. Co-ordinated-decentralized is meant to describe systems in which basic planning and management are left to provinces, regions, basins or states, incorporated, however, in a national framework which enforces consistencies with respect to water balances, budgets and limited national priorities. The association of a particular country with one of these classes has been accomplished only on the basis of the invited country papers and, as presented in the following annex, may not accurately reflect the real functioning of each system.

Several factors will clearly affect the choice of organizational structure: the size of the country, the political philosophy and tradition, the level of economic development and the scarcity of the water resource. The small and non-random sample of countries has not permitted any deeper study of the correlations among the influencing factors listed above and the actual choice or evolution of structure. None the less, it is hoped that the country outlines will create some impression of the existing range of variations in structure.

## Annex

## ILLUSTRATIONS OF COUNTRY ORGANIZATIONAL STRUCTURES, REPRESENTED BY AGENCIES AND THEIR TASKS

### Botswana

(Small area, centralized organization)

Central Government

Ministry of Water Affairs: formulation and implementation of national water development projects and policies, delegating as follows:

(a) Department of Water Affairs:
development and maintenance of surface water in rural areas

(b) Department of Geological Survey:
research in and development of ground water

(c) Water Utilities Corporation:
development and management of water supplies for major towns

Water Apportionment Board:
licensing of all large water schemes

District level

District councils:

(a) general planning of district development

(b) undertaking of minor water projects

District Land Board:
allocation of collectively held lands for agriculture and livestock, plus granting of permission to create or seek water supplies for that land

### Israel

(Small area, centralized organization)

Central Government

Ministry of Agriculture:
interministerial co-ordination

Water Commissioner's Office:

(a) licensing of water uses

(b) approval of new projects

(c) initiation of pollution controls

(d) co-ordination of annual budget preparation

(e) maintenance of a hydrological information system

Water Planning Organization:

(a) long-, medium-, and short-term development and management plans

(b) design of water, sewage, pollution control works

Construction and Operating Agency:

(a) construction of projects

(b) maintenance and operation of projects

Hungary

(Small area, centralized organization)

Central Government

National Water Authority:

(a) national responsibility for water management, directing the water-related activities of all agencies of government

(b) harmonization of water policies and general economic policy

(c) organization of international co-operation in matters of water management

Institute for Hydraulic Planning:

(a) design of works and projects

(b) projection of water requirements

(c) planning of river basins

Water Management Institute:

(a) development of techniques for the quantity and quality management of surface and ground water

(b) long-term planning of national and regional river basins

(c) development of procedures for economic analysis of water systems

(d) establishment and operation of the data bank for water management

Centre for Research Institutes:

(a) gathering of data on the hydrological cycle

(b) research on basic and applied hydraulic engineering

(c) research on water quality control techniques

District level

District water authorities:

(a) performing regional tasks of national administration

(b) construction, maintenance and operation of major water works belonging to the central Government

County council water section:

(a) water supply of towns and villages

(b) treatment and disposal of sewage

(c) operation of public baths

(d) local drainage and flood control

Water management associations:

(a) water supply and drainage for smaller settlements

(b) local flood control works

Indonesia

(Moderate area, centralized organization)

Central Government

Department of Public Works and Electric Power:
co-ordination of project planning, conservation and utilization of water

Directorate General of Water Resources Development: delegates functions to the following agencies:

(a) Directorate of Planning and Programming:
preparation of water plans and budgets

(b) Directorate of Irrigation:
design and construction of irrigation and drainage projects

(c) Directorate of Swampy Areas Development:
reclamation of swampy areas for agriculture and resettlement

(d) Directorate of Rivers:
design and construction of flood control and river improvement projects, including multipurpose projects

(e) Directorate of Logistics:
provision of materials and equipment for all activities under the Directorate General

(f) Institute of Hydraulic Engineering:
scientific support, software and data support for development programmes

Directorate General of Housing and Urban Development: delegates matters of water supply and sewage collection and treatment to the Directorate of Sanitary Engineering

## Iran

(Moderate area, centralized organization)

### Central Government

Ministry of Energy:

(a) preparation and execution of plans to pro ide and distribute water

(b) design, development and operation of urban and rural supply systems

(c) flood control

(d) rationing of water during drought

(e) creation of irrigation systems and organizations

Water Resources Research Institute

Institute of Hydrosciences

National Consulting Corporation

### Regional level

Regional authorities:

(a) assistance in regional administration and development

(b) formation of companies to supply water to towns and villages

(c) establishment of sewerage systems

## Argentina

(Large area, centralized organization)

### Central Government

Economic Ministry:

(a) development of national water policy

(b) development and supervision of all plans for public works and services

The Ministry further delegates to the following agencies:

(a) Secretariat of Natural Resources and Human Environment:
assisting the Ministry in matters of water

(b) Subsecretariat of Water Resources:

(i) formulation, financing and conduct of policies over the discovery, improvement and conservation of water

(ii) participation in the formulation of the national water plan

(iii) promotion and co-ordination of data gathering and studies of efficient water use and the control of pollution

(iv) maintenance of the national water and land registry

(c) National Advisory Council on Water

(d) National Institute of Water Science and Technology:
carrying out of water studies

(e) National Service for Rural Potable Water and Sanitation:

(i) execution of the National Plan for Rural Community Water

(ii) supervision of projects built

(f) Secretariat of Transport and Public Works:
planning and construction of waterways and ports

(g) Secretariat of Energy:
development and management of hydroelectric energy

(h) Secretariat of Economic Programming and Co-ordination:
integration of the programmes of all secretariats under the Economic Ministry

(i) Various national companies for flood control, irrigation, electric power, water licensing and sanitation

Regional level

Committees for the various hydrological basins:

(a) all hydrological matters within its area

(b) gathering of basin data

(c) advising the national Secretariat

Regional centres for ground-water investigations

Special national commissions for important basins:
especially the co-ordination of studies and negotiations with relation to international basins

## Union of Soviet Socialist Republics

(Large area, centralized organization)

### Central Government

Ministry of Water Management and Improvement:

(a) regulation of reservoirs and river flows

(b) annual and long-term water development plans

(c) co-ordination of water use rules with all relevant ministries

(e) technical and economic guidance on water use, including water quality

Ministry of Geology:
research and control over underground waters, including exploitation and water quality

Ministry of Energy:
planning, construction and operation of hydroelectric plants

Ministry of Fisheries:
control over fishery waters

Administration of Hydrometeorological Services:
data services for water quantity and quality

Ministry of Public Health:
control over sanitary conditions of water

### State level

State Ministries of Water Management and Improvement

State Ministries of River Transportation:
construction and operation of waterways and ports

State Ministries of Housing and Municipal Services:
sewerage and water supply for towns

Basin offices and inspection bodies:

(a) state control of water consumption and discharge

(b) development of measures for reducing consumption and pollution

(c) control of state-funded capital investments

German Democratic Republic

(Moderate area, co-ordinated-decentralized organization)

Central Government

Ministry of Environmental Protection and Water Management:

(a) ensures water supply of all segments of the population through surface-water and ground-water management

(b) efficient water-use plans and protection against pollution

(c) outlining of long-term trends in water development, including research

Research Institute for Water Management:

(a) co-ordination of all water research

(b) improvement of measuring and monitoring

(c) water and waste treatment technology

(d) information and data base

Enterprise of Design and Construction:

(a) design of all hydraulic structures, including those for other branches of the economy

(b) supervision of nationally owned enterprises for production of water equipment

Catchment area level

Directorates of Water Management:

(a) ensure catchment area water supply

(b) ensure efficient water use and management of structures

(c) flood and coastal protection

(d) studies of water demand

(e) evolution of comprehensive water development plan for the area

(f) ground-water exploration and evaluation

County (administrative unit) level

Water supply and sewage treatment enterprises:

(a) central drinking water systems

(b) treatment and disposal of domestic and industrial wastes

## Pakistan

(Moderate area, co-ordinated-decentralized organization)

### Central Government

Planning Commission:

(a) preparation of national development plans

(b) framing of development strategies

(c) issuance of principles and standards for water and related land planning

(d) progress and ex post monitoring of programmes

Ministry of Natural Resources:

(a) formulation of policy options for optimum development of water resources

(b) co-ordination of planning and development of water resources at provincial levels

(c) assisting the Planning Commission in development plans, flood control, reclamation and progress monitoring

Water and Power Development Authority:

(a) comprehensive master plan for optimum exploitation of national land and water resources

(b) plans for drainage and reclamation

(c) planning for irrigation, municipal water supply, and recreational water uses

(d) planning for flood control and watershed management

### Provincial level

Planning and Development Board:
analysis and approval of exclusively provincial water projects

Irrigation and Power Department:

(a) data collection

(b) maintenance of a portfolio of tentative water projects, plus preliminary evaluation

(c) implementation of approved water projects

(d) evaluation of operating criteria

(e) regulation of and collection of fees from irrigation projects and drainage and flood control projects

Flood Commission:
co-ordination of preparation of short- and long-term flood protection and control plans and projects

United Republic of Tanzania

(Moderate area, co-ordinated-decentralized organization)

Central Government

Ministry of Water Development, Energy, and Minerals: establishes water policy and delegates tasks as follows:

(a) Planning Division:
global water planning and interministerial liaison

(b) Project Preparation Division:

(i) collection and analysis of data to be used in project design, evaluation and construction

(ii) design of projects, including cost estimates and specifications

(c) Construction and Maintenance Division:

(i) construction of projects

(ii) operation and maintenance of projects

(d) Manpower Development and Training Division

Regional level

Office of the regional water engineer:

(a) design and execution of rural water supply programme

(b) co-ordination with Regional Development Director

Regional Water Advisory Board:

(a) issuance of water rights

(b) authority over structures and pollution

Special basin development authorities

Local level

Village water committees:
ensure participation of villagers in all stages of project formulation and especially in operation and maintenance

United Kingdom

(Moderate area, co-ordinated-decentralized organization)

Central Government

Ministry of Agriculture:
promotion of a national policy for water and execution of that policy

National Water Council:

(a) advising the relevant ministries

(b) promotion of and assistance on efficient performance by the (regional) water authorities, especially planning and research

(c) training and education of the water industry nation-wide

Water Research Centre:
carrying out research for the entire national water industry, including sewage and water treatment

Water Data Unit:

(a) advises on information required for water management and systems for its processing and storage

(b) ensures common standards and methods by the water authorities

(c) collection and publication of data on a national basis, as needed, by all agencies

Central Water Planning Unit:

(a) review of national and strategic aspects of water services planning and operation

(b) identification of long-term problems

(c) carrying out or promotion of related studies, including development of planning techniques

Regional level

Water authorities:

(a) provision of adequate water for domestic, industrial and agricultural demands

(b) provision of sewerage and sewage treatment for growing waste loads

(c) cleaning up the nation's rivers

(d) land drainage and flood protection

(e) conservation of anadromous and fresh-water fisheries

(f) planning of maximum use of water for recreation and amenity purposes

## Brazil

(Large area, co-ordinated-decentralized organization)

Central Government

Central Planning Board:
integration of regional plans

Ministry of Transportation:
planning, control, operation of fresh-water navigation and ports

Ministry of Agriculture:
meteorology and climatology

Ministry of Mines and Energy:
hydropower and water research

Ministry of Interior:
irrigation, reclamation, flood and drought, sewage and waste treatment

State level: depends generally on level of economic development but may include:

Water and Energy Authority

Sewage Works Company

State Sanitary Engineering and Environmental Protection Agency

Private and mixed electric power utilities

State Department of Agriculture plus research institutes and agricultural co-operatives

Committees for navigation on state rivers

Department of Tourism:
development of recreation

## India

(Large area, co-ordinated-decentralized organization)

Central Government

Ministry of Agriculture and Irrigation, delegating to:

(a) Department of Irrigation:

(i) national policy for irrigation and flood control

(ii) co-ordination of irrigation activities of States

(b) Central Water Commission:

(i) technical information data base

(ii) technical work in connexion with water resources development

(iii) facilities for design, evaluation and execution of water development projects

(iv) research activities

(v) technical examination of projects proposed by states

(c) Central Board of Irrigation and Power:

(i) co-ordination of all research on water development

(ii) liaison with all international technical organizations

(d) Department of Agriculture:
national policies for ground-water use and minor irrigation

(e) Central Ground-water Board:

(i) exploration assessments and management of ground-water resources

(ii) liaison with state boards

(f) Control boards for specific projects

State level: arrangements differ from state to state. Each carries out projects generally within its jurisdiction through its departments and agencies.

## Mexico

(Large area, co-ordinated-decentralized organization)

### Central Government

Ministry of Water Resources, which delegates responsibilities as follows:

(a) Subsecretariat of Planning:

(i) formulation of priorities and alternatives for short- and long-term development of water resources

(ii) supervision of all studies, plans and programmes in water resources

(b) National Water Plan Organization: broad national and regional planning through the interpretation of national goals and policies into water quantity and quality demands; integrative studies to co-ordinate programmes of the Ministry with other agencies for the design of administrative and structural actions to efficiently accomplish irrigation, flood control, drainage, water supply and water quality control

(c) Directorate of Planning:

(i) formulation, evaluation and integration of water plans

(ii) making studies of water demands, with special emphasis on agriculture

(d) Directorate of Water Use and Pollution Control:

(i) issuance of regulations on water use in the different basins

(ii) making plans for the control of water quality in each basin

(iii) updating of the national water-use inventory

(e) Subsecretariat of Construction:

(i) to undertake engineering, economic and social studies and research relating to the design and operation of irrigation, river control, potable water and sewerage plans and projects

(ii) to supervise all construction

(f) Subsecretariat of Operation:

(i) co-ordination and control of the operation of the irrigation districts

(ii) establishment of a data base on irrigation productivity and technical and economic conditions in the districts

(iii) supervision of federal potable water systems and co-operation with state and municipal authorities on potable water and sewerage

Federal Electricity Commission:
planning and execution of hydropower projects

Regional level

River basin commissions:
study, design, construction and supervision of control works, irrigation, diversion of water to population centres, and all works and services relating to communication and urbanization

State level

State boards of potable water and sewerage

Irrigation districts: construction and operation of major irrigation projects

## France

(Moderate area, decentralized organization)

### Central Government

National Water Board:
advisory role on pollution control, large-scale regional development and on all problems common to two or more river basins

Interministerial Water Commission:

(a) co-ordination among various ministries concerned with water

(b) giving opinions on programme priorities and distribution of funds among ministries

(c) giving opinions on laws and directives drawn up by the water-related ministries

Permanent Secretariat for the Study of Water Problems:

(a) preparatory work for the above Commission

(b) provision of technical advice, research and a secretariat for the National Water Board

(c) provision of the direct linkage between the Commission above, the river basin agencies and the regional technical water committees

### River basin level

Basin committees:

(a) advisory bodies representing water users, local and central government and consulted by the ministries on the suitability of suggested development plans

(b) advice on and approval of charges to be made by the river basin agencies

River basin agencies:

(a) preparation of multiyear programme of action, with related studies and research

(b) consultation in design, execution and operation of community or individual water projects

(c) levying of charges against pollutors and beneficiaries of basin services

Regional technical water committees:
ensure co-ordination of water policy at the regional level

## Spain

(Moderate area, decentralized organization) a/

Central Government

Ministry of Public Works, General Board for Hydraulic Works: delegates responsibilities as follows:

(a) Commission for Water Management and Pollution Control: administration and control of use, development and quality of waters

(b) Subdirectorate for Studies and Planning: data base maintenance, technical economic planning, standardization of techniques and methodology

(c) Hydrographic Studies Centre: advice to Subdirectorate above

(d) Subdirectorate for Works and Projects: supervision and control of construction

(e) Subdirectorate for the Geological Service: geological reconnaissance of project sites and ground-water studies

(f) Subdirectorate for Exploitation: setting of guidelines for priorities in use and setting of rates and tariffs

Regional level (hydrographic units)

Water commissions:

(a) police regulation of waters

(b) control of execution of concessionary works

(c) training of irrigator communities

(d) registration of water developments, inventory of existing projects

(e) census of residual waters

Hydrographic confederations: autonomous organizations of state administration representing the parties affected by water development in the basin:

(a) activation of the development of works

(b) determination of services to be rendered and charges to be made

(c) operation and maintenance of works

(d) representation of the interests of basin occupants in their contacts with the water commission and higher levels

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a/ Explicitly a function of the degree of basin development.

## Canada

(Large area, decentralized organization)

### Central Government

Department of Environment:

(a) entering into agreement with the provinces for comprehensive water quantity and quality management on a basin-by-basin basis

(b) acting unilaterally, if necessary, on certain urgent pollution or international problems

### Joint central-provincial level

Consultative Committees:
broad supervisory and priority-setting agencies established by formal federal-provincial agreement

Basin planning boards:
established by joint agreement to supervise comprehensive studies and the drawing up of comprehensive basin plans

Basin implementation boards:
overseeing the implementation of the first phases of the plan, especially construction and institutional development

### Provincial level

Department of Environment and/or Resources:

(a) planning and regulation of water use within the province

(b) entering into joint planning and development agreements with the federal Government

(c) delegation to municipal or regional governments of responsibility for local matters of water supply, sewage collection and treatment, land use planning and recreation

Department of Health:
imposition and supervision of minimum water quality standards

Department of Tourism:
water recreation

Departments of Public Lands:
recreation planning of land and associated water use

Departments of Fish and Wildlife Management:
water and habitat protection

Semi-autonomous public corporations for hydroelectric and thermal power

United States of America

(Large area, decentralized organization)

Central Government

Federal Coordinating Council:

(a) maintenance of a continuing assessment of water supplies and demands in each water resource region

(b) preparation of periodic reports on the status of water problems

(c) establishment of principles and procedures to be followed by all federal and federally aided agencies in the preparation of regional or river basin plans and projects

(d) assistance in the creation of river basin commissions and reviewing of all plans generated by such commissions with respect to economic efficiency, the effect on other programmes and contributions to national goals, transmitting recommendations to the executive

Department of the Interior:
delegation of responsibilities to special agencies for the promotion, construction and operation of multipurpose irrigation, power and flood control systems

Defense Department:
delegation to special agency responsibilities for planning, construction, and operation of inland and coastal waterways, flood control, power and water supply systems

Department of Agriculture:
delegation to special agencies programme responsibilities for small watershed management, offering technical and financial aid to municipalities and individuals in water control and soil management

Regional level

River basin commissions:

(a) principal co-ordination of federal, state and local water planning

(b) preparation and updating of a comprehensive plan arrived at co-operatively with federal, state and local interests for the optimal development of water and related land resources

(c) recommendation of long-range programmes of data collection and analysis

Interstate compacts:
legal agreements among states to join in programmes of mutual interest, including water management

Regional economic development commissions:
planning of programmes, including water development, for the stimulation of economic growth in low-income regions

State level

State departments of natural resources, water or planning:
planning of intrastate projects and programmes, to initiate requests to federal commissions

Intrastate special districts:
many types of special-purpose units, usually established voluntarily by beneficiary groups to accomplish soil conservation, drainage, water supply, irrigation or flood control

### C. Arrangements for co-ordination of planning, project construction and management among agencies

Arrangements for co-ordination are very often informal - the product of the evolution of practice over time. Some countries have difficulty in identifying and describing such procedures. However, unless such procedures are institutionalized, they can be pushed aside, especially as personnel who once may have formed an effective informal team retire or change positions.

The arrangements explicitly identified by the countries surveyed are listed below according to the type of water planning organization (centralized, co-ordinated-decentralized, decentralized), a factor which can be expected to influence the arrangements chosen.

#### Centralized organizational structures

##### Interministerial or interprovincial co-ordination

Co-ordinating committees of relevant ministries must approve all major projects;

Top planners in each ministry are seconded to those ministries from the ministry of planning and finance after training in the appropriate budget and co-ordination procedures;

Regional water authorities have representatives from each relevant ministry;

The state planning commission co-ordinates the programmes proposed by the water sector with over-all economic plans. Specific steps taken depend upon the nature of the activity: research, planning or operation;

A natural resources technical committee provides a regular forum for the review of programmes from an objective, technical, interministerial and interdisciplinary viewpoint.

##### Intra-ministerial co-ordination

Top water agency persons form a "water forum" which holds regular meetings to review programmes and co-ordination;

In a region where boreholes are a crucial part of the water programme, a borehole co-ordinating committee meets monthly to review and co-ordinate drilling, maintenance and progress on other projects dependent on boreholes.

Co-ordinated-decentralized organization structures

Interministerial or interprovincial co-ordination

Central government co-ordinates all interprovincial river projects;

Ad hoc co-ordinating committees are set up for the planning and construction of large projects;

A special central committee is used to resolve interprovincial development projects;

Co-ordination is made difficult by reallocation of project funds from one project to another and by lack of standardized designs, construction methods and materials;

Chief executives of regional water authorities have regular meetings, as do their directors of finance, operations and planning.

Decentralized organizational structures

Interministerial or interprovincial co-ordination

Special routing schemes for approval of special types of projects, e.g., irrigation schemes go to hydrological office, hydroelectric authority etc.;

Co-operatively negotiated planning and construction committees bring together central and provincial resources for basin planning and execution;

Interagency basin committees exist for each basin and co-ordinate and co-operate in building of data base and broad framework projections and plans;

River basin commissions informally co-ordinate national, provincial and local efforts at river basin development.

## D. Water agency linkage to the decision makers

Every country has fairly elaborate bureaucratic procedures for the development of plans and project approval. Where the Government is highly centralized with a relatively weak legislative branch, these procedures seem to suffice. In less centralized countries with powerful legislative branches, the usual bureaucratic linkages often do not reach the legislature, and explicit informational and educational linkage seems called for. However, it is seldom found.

Centralized organizational structures

The planning and budget office organizes recommendations from the ministries, shapes them according to availability of funds, and presents the resultant programme to the legislature;

The water ministry prepares special memoranda and study papers for the cabinet;

The high degree of political consensus that is required prior to the acceptance of the economic plan calls for repeated rounds of exchanges of information.

Co-ordinated-decentralized organizational structures

Development projects must appear in the long-term development plan. Projects, as called for in the plan, are submitted to regional authorities for comment and on to the appropriate central ministry which can approve on the basis of criteria set by the planning commission;

The system of corporate planning adopted by the regional water authorities requires central government inputs at several distinct points.

Decentralized organizational structures

Central and provincial ministries are given substantial latitude in setting priorities and selecting projects within broad budget guidelines;

Special legislative committees of the central government have jurisdiction over the various water agencies and their programmes;

Occasional national commissions are formed to call attention to problem areas and to make recommendations to the legislative and executive branches.

## E. The funding of planning research, construction and operations

The methods of funding are shown below according to type of organizational structure. It is difficult to detect any significant differences in funding practices according to the degree of centralization of the organizational structure. An expected feature which does not appear is a greater degree of dependence of the more decentralized systems on user charges, i.e., directly water-linked prices or tariffs. The implications of funding arrangements for efficient water development and use must be considered thoroughly.

Centralized organizational structures

Planning research

Central government recurrent budget

Central government development budget

Construction

Central government development budget

Surplus funds from user fees from municipal and agricultural projects

Co-operative associations of the land-owners' share in funding

Operation and maintenance

User fees, with the recurrent budget covering deficits

Subsidies for agricultural projects are typically heavy, even for operating expenses

User fees cover only O and M, and inflation has seriously impaired this coverage

Operation and maintenance on smaller projects are carried out by beneficiary groups, helped at times by government aid in the form of food and supplies

Co-ordinated-decentralized organizational structures

Planning research

Central government development budget

Planning - central recurrent budget

Research - subscriptions from all water authorities, including private

Assistance from international agencies in setting up planning procedures

Construction

Federal and provincial development budgets

International agencies

Borrowing from the national loan fund with later repayment

Nationally owned water enterprises such as water supply and sewage treatment are totally self-financed

Operation and maintenance

Water charges and property taxes

All water quality-control programmes are state-funded

Decentralized organizational structures

Planning research

Planning is financed jointly by the central and provincial governments on a negotiated basis for each major problem or basin

Central government recurrent budget

Construction

Central development budget

Hydro-electric works are totally self-funded

Irrigation works are privately and state-funded, the percentage of each depending on the nature and size of the project

Provincial-central government funding, but the central government holds construction funds as an inducement for provincial-central collaboration

Central government capital budget, subject to repayment by each project, which is highly subsidized through low interest rates, grace periods etc.

Operation and maintenance

User charges but some purposes, e.g., flood control, are not charged

Annex

## THE EFFECT OF PROPERTY RIGHTS AND ADMINISTRATIVE ARRANGEMENTS ON THE EFFICIENCY OF WATER USE: A BRIEF EXAMPLE

Hartman and Seastone (12) have provided an incisive analysis of the impacts which institutions, including laws, can have on the efficiency of water use in arid regions. We here relate only the cases of two large water conservation districts in the State of Colorado, United States of America, which are responsible for the distribution of irrigation and municipal water from two federal water supply projects. One seemingly minor legal detail has caused the efficiency of irrigation water use to be vastly different in the two districts.

The Northern Colorado Water Conservancy District was established to develop and distribute water in a 2,300 square mile area of north-eastern Colorado. While some local river flows were available for distribution, most of the water was to be provided by a new federal storage and diversion project named the Colorado-Big Thompson project, which diverted water from the western slopes of the Rocky Mountains to the eastern slopes and plains. The amount of water handled annually is about $380 \times 10^6/m^3$.

Water allocations were originally made to landowners, municipalities, and industries in the District, irrigation being by far the largest user. The shares so distributed are freely salable among parties located within the District, so that permanent sales of water from less productive to more productive uses can take place. Seasonal water rentals also take place. If a farmer finds that his allotment for the year is more than his planned crops or livestock will require or if high prices offered for the seasonal transfer of water make it attractive to reduce his application, he can advertise through the District office that some of his water is available for sale for that year at whatever price he cares to ask. Farmers seeking additional water can then bargain with sellers of water, and a very smooth market process has developed. Seasonal rental prices of water sometimes reach \$25 per $10^3/m^3$.

As a result of this ready market for water, water use is carefully planned. Since there is no danger of losing one's permanent water rights by a sale of part of one's annual allotment, farmers prefer to sell the water if its value rises above the return they can obtain on their own farm. The economic efficiency of water use is very high.

The South-eastern Colorado Water Conservancy District has more recently been formed to distribute the water supplied by the Frying Pan-Arkansas Project, another large federal water storage and diversion project. A prime purpose of the District was maximum conservation and efficient use of the waters diverted from the western mountain slopes.

The regulations of this District specifically preclude the resale of water among parties served by the District. Those holding contracts for water delivery can only resell on a permanent basis to the District itself at the very low initial contract price. No seasonal rentals of water among users are allowed. Any farm exhibiting excess water supply can have the excess taken away and redistributed.

Thus, in the South-eastern District, there is no financial motivation for conserving irrigation water. The resale price to the District is trivially low. Since excess water cannot be sold to other users but can be taken by the District, no one allows excess water to appear. Excessive applications are made to crops, even beyond the point of maximum physical yield. No market for water exists, and no incentive for efficient use exists.

## IV. CRITERIA FOR THE EVALUATION OF INSTITUTIONAL PERFORMANCE

We present here a conceptual framework which has evolved from the blending of practical planning experience and insights from the behavioural and social sciences. We conceive of a hierarchy of objectives, starting with explicitly stated national or social goals and proceeding into the greater detail of the performance and form of the institutions through which society seeks to optimize the achievement of its goals. The figure below helps in conceptualizing the system of relationships. At the level of institutional design lie the observable characteristics of the water planning agencies and the relationships linking them. For example, Is the ownership of water clearly defined? What legal authority has been given to the various water agencies? Are there clear national policies in related areas (e.g., agriculture, transportation) so that inconsistencies of water policy with other policies can be minimized? Are there explicit mechanisms for co-ordination among water agencies?

Secondly, we have the criteria which might be employed by administrators and policy makers in judging how well the water agencies are functioning. For example, Is an imaginative range of alternative solutions to problems considered before a final choice is made? Are externalities evaluated and taken into account? Do planning agencies and their procedures reflect changing national and local priorities? Is planning really forward-looking or is it always just responding to crises? These seem to be the types of criteria that broadminded upper-management personnel would apply to evaluating a system or an agency.

If the performance criteria are to make social sense, they must relate to the basic national goals. That is, high ratings on each criterion must indicate a high probability that the performance of the institution being evaluated will contribute significantly to at least one of the national goals.

### A. Criteria and related characteristics

A set of performance criteria which has grown out of planning experience is given below. Each criterion is followed by examples of characteristics which, in the surveyed countries, have been observed to aid or hinder performance as measured by that criterion. 2/

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2/ The participants in this study were asked to consider the set of performance criteria listed below and then to describe those characteristics of the water planning and management systems in their countries which aided good performance or prevented good performance according to each criterion. The remainder of this section presents the characteristics according to the criterion to which they relate. In some cases, the same characteristic is shown contributing to performance according to several criteria. The description of each characteristic has been kept short and as true to the original country description as reasonable condensation has permitted.

Institutional characteristics
(contribute to (or detract from) (performance as (measured by ...)
Institutional performance criteria
(performance (contributes to (the achievement) (of ...
National goals
Water ownership clearly defined
Legal authority to enforce decisions
Clear national policies in related areas
Mechanisms for co-ordination
Consideration of alternatives
Take account of externalities
Responsive to national and local priorities
Expeditious movement from planning to implementation
Economic growth
Equity
Environmental protection
Economic independence

Criterion A: Generation of reliable information on a range of alternative solutions to water problems

Positive characteristics

The encouragement of private engineering firms to survey, design, prepare and propose projects;

The creation of public-sector consulting engineering groups to serve the needs of public agencies;

The use of local knowledge, e.g., asking local people to suggest solutions to problems or help to provide data on subjects such as rainfall;

The existence of computer models for evaluating data and designing optimum sequences of projects;

Private organizations of parties affected by water plans exist in every region, along with public agencies. Thus, both private and public interests are represented in proposals emanating from the region;

Water scarcity in arid areas is so great that all alternatives, traditional and non-traditional and including the careful location of water-using activities, must be considered;

The creation of a national water plan composed from regional water plans;

The establishment of river basin data centres;

A close water observation network;

The development of good demand forecasts, as functions of water prices and other factors.

Negative characteristics

Modern systems techniques of analysis are limited by educational and cultural factors;

Water agencies have evolved out of highly specialized earlier functions, e.g., irrigation only or navigation only;

The lack of information on the importance of the reliability of the water supply;

The lack of information on patterns of household water use;

The lack of hydrological and social data.

/...

Criterion B: Capability and motivation to take into account all significant positive and negative externalities 3/ arising from water development and management

Positive characteristics

The use of a 50-year planning horizon, especially with respect to water quality;

The water authorities are multipurpose by law, being required to look at water quality, amenities, drainage, flood protection, fisheries and recreation;

The existence of a legal obligation to secure the use of water for recreation, the preservation of natural beauty and the conservation of flora and fauna;

The terms of reference of all planning studies are broad enough to ensure that effects on agriculture, fisheries, forestry, ecology and social conditions are taken into account. Detailed guidelines for project analyses are promulgated by the national planning office;

The basic planning and management units are river basin authorities which cover the entire country without overlap;

All alterations of water quality are liable to a monetary charge;

Water management agencies have power over land adjacent to water bodies.

Negative characteristics

Major national programme (e.g., agriculture and water) are not well co-ordinated;

Countries at lower income levels concentrate on the income-generating capabilities of projects, while externalities are often related mostly to the quality of the environment;

The technical training of engineers is not sufficiently interdisciplinary;

The lack of base-line and current data on environmental conditions;

The lack of any set of water quality standards or laws covering ground-water contamination;

Non-water agencies do not analyse the impact of their projects on water quality.

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3/ "Externalities" refers to costs imposed or benefits bestowed on outside parties because of actions taken by another party.

Criterion C: Information generation and decision-making should be responsive to national and local priorities

Positive characteristics

Highly centralized planning guarantees the reflection of national priorities;

All agencies follow national priorities in the national development plan;

Specific goals of national interest are specified in each five-year development plan;

All national water plans are jointly agreed to by federal and provincial governments;

Increased association of local political representatives with the water agencies;

Project initiation takes place at the district and subdivision level;

Small projects can be approved at the provincial water agency level;

Regional water authorities must have more local appointees than those appointed by the central government;

The use of local general advisory committees within each regional water authority;

River basin agencies are responsible for technical and economic management within their basins;

All development proposals originate in regional authorities and are carried upwards from there;

Village water committees are used to ensure participation in programme formulation and, especially, operation and maintenance.

Negative characteristics

No clear statement of the national objectives which are to be achieved through water development and management;

Decision makers want overly simple responses to their questions (e.g., they ask water specialists to indicate the most appropriate solutions);

The veto power of decision makers over programmes exceeds their ability to achieve constituent agreement on programmes.

Criterion D: Expeditious movement from planning to implementation

Positive characteristics

Active co-ordination among water agencies;

The use of fixed time schedule contracts, especially with external contractors;

The existence of a steady progression of long-term, medium-term and annual capital plans establishes a regular progression from concept to execution;

The execution of projects according to plan schedule is required by law;

Very generous funding of construction;

Detailed design and planning (contrasted with pre-investment reconnaissance studies) proceeds only on projects likely to be selected and funded in the near future.

Negative characteristics

Delays in releasing funds often hold up and sometimes destroy projects in the field;

The shortage of implementation capability, especially in terms of the inelastic and erratic supply of professional and senior technical staff;

A national shortage of infrastructure facilities;

Controversies over development criteria adopted by key foreign experts;

Difficulties among ministeries, especially when they hold joint jurisdiction over programme or projects, e.g., in sewage treatment and reclamation;

The reliance on foreign funding;

The lack of previous experience in certain fields, e.g., navigation;

Projects must be approved as part of both the development budget and the public works budget;

Water agencies promote many local projects oriented towards special interests which then get studied but lack the qualifications and political support for funding.

Criterion E: Programmes should be economically efficient, or deviations from economic efficiency should be explicitly justified in terms of other goals 4/

Positive characteristics

Water planning and project evaluation are institutionally separated from construction;

Benefit-cost ratios are required to exceed 1.5 except for projects in backward regions, where the requirement is 1.0;

Alternative locations are usually considered for large water-using activities;

Disincentive block rates (price structures) are used to reflect increasing long-run incremental costs of water;

Cost ceilings are set by law on water to be provided for irrigation;

Urban water supplies are always provided on a strict commercial basis (full cost recovery);

There is explicit planning for the correction of regional income discrepancies (i.e., the equity or distributive objective);

Other social goals are given explicit "weights";

Economic efficiency is always emphasized by low-income countries;

Proper income distribution and the alleviation of social unrest are explicitly stated as objectives of planning;

All affected parties are requested to respond to the economic analyses of projects;

River basin agencies are empowered to levy charges on any water abstracted or consumed;

Grants and loans can be made to public and private parties for any work which would be of benefit to the basin, including changes in production processes (especially important with regard to pollution control);

Alterations of water quality are liable to a charge;

Private efficiencies are stimulated by charges for water withdrawal;

Consumption norms are used to educate and judge public use patterns;

Highly organized user confederations push for efficiency and appropriate operation.

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4/ In this context economic efficiency refers to maximizing the difference between quantifiable benefits and costs.

/...

Negative characteristics

A "requirements" approach to demand is used, without the association of benefits with uses;

General non-water planning proceeds on the expectation that water supplies will always adapt to other conditions;

Too much weight is carried by political expediency, without any input of technical analyses;

Water use permits (rights) are permanently attached to fixed parcels of land, or the water ownership system otherwise makes transfers of existing water supplies among uses quite difficult;

There exists a great overemphasis on construction and capital outlays in contrast to improved operation and maintenance, partly because such steps are more easily known and partly because of the monument-building inclinations of planners;

Insufficient money for planning, field surveys and investigations relative to construction funds;

So much money for construction that there is not enough time to evaluate projects;

Investments tend to be made in order to maximize the financial return to the Government rather than the net social benefits, regardless of form;

Water is paid for through property taxes rather than through quantity-related charges;

Excess water, even if brought in a private canal, is considered public property;

Operating and maintenance costs are not fully recovered through beneficiary charges, especially for rural water projects; 5/

Too many projects cater to special-interest groups only.

Criterion F: Sufficient continuity of staff and assigned responsibilities that expertise accumulates

Positive characteristics

Recruitment on the basis of professional competitive examinations;

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5/ Charging less than O and M costs leads to economic inefficiency in water use, but it may assist in achieving other goals, e.g., a more equitable income distribution.

Promotions are made on the basis of performance, with no political influence on employment;

Job security is provided, but opportunities are kept open for employees to take upon themselves additional responsibilities;

Regional water authorities are big enough to have not only operational divisions but also administrative policy-making divisions. Thus, there exist advanced promotion possibilities within the water resources area;

Effective counterpart personnel programmes can be arranged, thereby transmitting expatriate expertise to local personnel. (Note. In most cases, this has proved to be very difficult.);

Strong programmes for the use of indigenous personnel, even when they are not as well qualified as expatriates or consultants.

Negative characteristics

The shortage of trained personnel leads to "job-hopping" and too much mobility;

Expatriate personnel on short-term contracts leave just as they are getting well acquainted with the job;

Water resource agency promotional opportunities are limited so that the best personnel must leave the water area to get ahead;

Public agency pay is too low compared to private and parastatal organizations;

National educational institutions are not capable of producing professional and technical personnel;

Institutional reorganization and administrative reform take place too often and are disruptive;

Major planning efforts are carried out by ad hoc joint federal-provincial committees which are then disbanded.

Criterion G: Ex post monitoring of water project and system performance so that evaluation is made, responsibility established and learning takes place

Positive characteristics

The existence of an explicit programme for monitoring the following parts of a project: conditions imposed on water licence holders; construction costs; hydrology; performance of all installations; economic, social and ecological impact;

The use of management accounting systems assists in learning and placing responsibility;

For all major studies, initial bench-mark studies are later followed by follow-up studies;

Highly organized user confederations push for efficiency and appropriate operation.

Negative characteristics

The existence of the attitude that the Government cannot be allowed to be wrong.

Criterion H: The system should stimulate innovation and initiative in approaches to water-related problems

Positive characteristics

Allowing a certain amount of duplication among water agencies at the conceptualization stage of programme and project development creates a kind of competitiveness which is conducive to innovation;

The use of steering and programme review committees which include outside (non-water agency) and even foreign members;

The provision of study tours for employees, both abroad and at home, through courses, conferences and seminars;

Foreign missions, consultants, and interantional agencies have introduced a spirit of innovation;

Experimental facilities are tried by the Government;

The national network of academic and research establishments is devoted to water management studies;

The promotion of private innovation through charges for water and waste disposal;

Compensation and prizes for innovative ideas adopted by agencies;

The encouragement of private sector firms to produce development project ideas;

Strong decentralization of the water programme gives more room for innovation;

Close co-operation and exchange among allied countries;

Village committees are relied upon for input of development ideas and priorities;

Salaries have a fixed and variable component, the latter being dependent upon the initiatives and efficiency shown.

Negative characteristics

Asymmetric reward and penalty structures in which deviations from established procedures are punished but in which innovation is seldom rewarded;

Overcentralization of planning and authority prevents the exercise of initiative at lower levels, and good performance at regional and lower levels often passes unnoticed;

Inadequate salary and promotion opportunities to attract the desired kinds of personnel;

Too much "top-down" pressure can be dysfunctional, causing personnel to emphasize only quantifiable goals and tending to lead to the distortion of information in order to overstate achievement. There is also the possibility that the form of activities will be substituted for the substance and that work will not be varied to suit local conditions;

The type of education as well as the socio-cultural stratification are not conducive to innovative activity;

Not enough money for research;

Labs and field labs are supposed to help with new developments but are always swamped with everyday activities.

Criterion I: The planning and management system should be forward-looking and not merely react to problems when they arise

Positive characteristics

The existence of short-term, five-year, and long-term national development plans;

River basin agencies are required to prepare multiyear plans of the activities;

The agency separation of long-term and short-term planning;

Allowing "grey areas" between longer-term and shorter-term planning, in which some duplication and competitiveness are allowed to develop;

The existence of an explicit legal and institutional review group to work with long-term planners;

The existence of a three-phase scheme which permits forward planning resources to be used where needed. Rivers are classified according to the extent to which available water is used:

(a) Phase 1 - below 50 per cent use: planning merely responds to local needs, mostly through surface development;

(b) Phase 2 - between 50 per cent and 80 per cent use: planning becomes more sophisticated and greater care is taken in the management and allocation of water;

(c) Phase 3 - above 80 per cent use: careful conjunctive management of surface and ground water is introduced, plus reallocation of water supplies from lower value to higher value uses, plus higher cost supply techniques, such as interbasin transfers and desalting.

Negative characteristics

The federal-provincial agreement that is required on plans can frequently be stimulated only by the existence of an immediate problem.

## B. Application of the analytical framework: an example

To illustrate a possible application of our institutional evaluation framework, the following imaginary scenario has been developed. The scenario includes problems frequently found in practice.

### Scenario

A country of moderate size is roughly divided into a well watered half and a semi-arid to arid half. There is only one substantial river which rises in the well watered regions close to the rapidly growing capital city. The river then encompasses a large basin, passing first through areas where supplemental irrigation would yield some benefits, thence into a heavily populated semi-arid region suitable for irrigation but also representing the reach of the river in which a large power head could be developed. Finally, the river passes through a large arid region which is difficult to make habitable and on to the coast, where it enters a bay widely used for tourist recreation.

Other parts of the country are well watered and consist of drainage areas closely corresponding to the boundary lines of the provinces. The large river basin, however, includes large parts of several provinces.

Water law remains ill-defined. Tradition has permitted any locality or individual to withdraw desired quantities of water without limit. Until recently, the lack of pressure on water resources and geographical features have permitted such a system to work satisfactorily. In recent years, however, increasing pressures on water quantity and (for the first time) quality have been felt.

Several obviously unsuccessful irrigation schemes which have failed to attract settlers or have failed to produce design crop yields have attracted unfavourable public attention. Looming in the near future is a serious conflict between irrigation and power development in the upper reaches of the big river.

All these matters have led to a major review of the institutional framework for water planning and management. The following ministries or independent agencies were found to have water planning and/or management responsibilities:

Ministry of Power and Communication (hydropower);

Ministry of Agriculture (minor irrigation and rural potable water supplies);

National Irrigation Board (major irrigation, development and management);

Ministry of Public Health and Local Affairs (village water supplies);

Ministry of Tourism (development and management of coastal recreational areas).

The following explicit problems were found to exist in the major river basin:

Increasing political pressure to develop large-scale full-irrigation projects in the upper parts of the basin;

An increasing volume of unsupervised small-scale abstractions for irrigation close to the river banks, resulting in substantial added consumptive use and heavy siltation;

Increasing attractiveness of hydroelectric power in comparison to thermal-electric power;

Heavy silting of the bay and beaches at the coast, damaging their attractiveness for recreation;

Denuding of semi-arid bush lands for dry land agriculture and/or fuel gathering, resulting in heavy soil loss and siltation during the rainy season;

A growing demand for water in the capital city, the most likely source for which appears to be an interbasin transfer out of the major river's headwaters.

The problems associated specifically with law, organizational structure, co-ordination, linkage and funding were defined as follows on the basis of the above information:

Water law

The vagueness of the law makes it difficult for any government agency above the level of local government to claim powers of licensing and managing water withdrawals. The lack of clear individual title to the water makes market processes of allocation and reallocation impossible.

Organizational structure

The individual ministries seem well adapted to their major missions, but there is little collaboration among them on water. No mechanism exists for making the water programmes of the various ministries and water agencies consistent with each other, for avoiding duplication and for avoiding externalities on each other's programmes. Water affairs are not formally organized at the provincial or local level.

Co-ordination

No mechanism exists for co-ordination among the ministries on water matters, or between the National Irrigation Board and the ministries. As a result, the national power plan calls for hydropower developments on the upper reaches of the major river which are totally inconsistent with the water-use plans of the Irrigation Board and the water-supply plans of the Ministry of Public Health and Local Affairs for transferring water to the capital city. Failure to control land-use in the agricultural areas close to the river results in excessive soil loss, siltation of storage, damage to turbines and siltation of beaches.

Linkage

Water is a relatively small part of the total responsibility of the various ministries. The Irrigation Board, being an independent executive agency, has no direct representation in the legislature. Thus, there is no clearly identified voice to speak for water affairs, and legislators find it difficult to know where to turn for information or to transmit local needs and priorities.

Funding

All the above factors mean that there is no uniform pressure over time for adequate funding of water planning and construction. Funding is irregular, and agencies like the Irrigation Board are forced to look abroad for the funding of studies and projects.

A consideration of the various performance criteria helped to identify the following negative characteristics of the various water agencies:

Criterion A (range of alternative solutions to water problems): The water agencies are so highly specialized in particular technologies that no single agency has the competence to look at a range of alternatives;

Criterion B (take externalities into account): The lack of good water-, soil- and land-use data make externalities difficult to detect and assess, e.g., the origins and volume of siltation;

Criterion C (responsive to national and local priorities): The Irrigation Board has no offices in the provinces, and the ministries have no water experts in their provincial offices;

Criterion D (expeditious movement from planning to implementation): Irregular funding arrangements often leave good projects unfunded for long periods. The shortage of professional personnel slows up construction;

Criterion E (economic efficiency): Water planners are not trained in economics and utilize a "requirements" approach to all supply planning. Externalities are never counted as costs;

Criterion F (continuity): Under current organization, there are few high-grade civil service posts in the water agencies, so good people must leave the water field for promotion. Also, there is a heavy dependence on foreign consultants;

Criterion G (ex post monitoring and learning from experience): No funds are ever provided for ex post monitoring. Agencies attempt to cover up mistakes;

Criterion H (stimulate innovation): Rewards for innovation within the water agencies tend to be low, while penalties for failure are high;

Criterion I (forward-looking planning): Long-term planning is not separated from solving day-to-day operating problems. Thus, long-term planning gets pushed aside.

We hope it is clear that the framework presented in this paper permitted our imaginary country to systematically analyse the problems it was experiencing with water planning and management. The ranges of alternative arrangements and organizational structures and the lists of positive characteristics associated with each performance criterion will now assist the country by suggesting positive institutional changes which can be made.

## V. CONCLUSIONS

The first thing gained from assembling the foregoing materials is the following list of issues which are important determinants of water planning and management performance:

Basic water laws and traditions;

Forms of organizational structure;

Arrangements for co-ordination among water agencies and between the water sector and other sectors (e.g., agriculture, power);

Arrangements for linkage of technical water planning and management to political decision makers at the local and national levels through two-way information flows;

Arrangements for adequate and reliable funding of planning, research, construction and operations.

In addition to this list of issues, we have exhibited for each issue a range of practices actually followed by a number of countries which span all conditions of water availability, country sizes and stages of economic development. Arrangements utilized by countries falling into the same size class and exhibiting similar degrees of water management centralization or decentralization can be scanned in the search for alternatives. It is this awareness of existing alternative arrangements which is the first payoff.

For a given set of "rules of the game", organizational structure, and publicly held values, it is possible to become more definite about what constitutes good performance. The set of criteria given in section IV provides a normative basis for at least a qualitative evaluation of the performance of a particular institutional framework. A significant group of experienced water planners agree to the relevance and importance of this list, although other criteria might be added to it.

The lists of characteristics positively or negatively associated with each criterion in section IV provide a partial normative approach to the design of water institutions. These characteristics represent observable features of organizations capable of being controlled and purposefully effected. The positive characteristics have been found in the actual practices of the surveyed countries to improve performance according to the associated criterion. The negative characteristics similarly have been found to reduce or degrade performance. These proven characteristics provide a handle on ways of improving institutional performance.

Someday it may become possible to carry out a full benefit-cost assessment of alternative institutions. We do not possess that capability at present. However, an awareness of the importance of the institutional framework and continued exchanges of experience can lead to significant improvement.

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